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COMMITTEE ON THE PEACEFUL USES
OF OUTER SPACE

NATIONAL RESEARCH ON THE QUESTION OF SPACE DEBRIS

Note by the Secretariat

Addendum

The present document contains information provided in replies received from Member States up to 26 February 1992.

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RUSSIAN FEDERATION

[Original: Russian]

The littering of circumterrestrial space with fragments of space technology is a global problem that affects the interests of many countries. There are currently, in low-Earth orbit, approximately 7,000 artificial objects (non-operational space vehicles, rocket stages, large structural debris), which are tracked by space monitoring means, as well as tens and hundreds of thousands of fragments of various dimensions. The annual growth of fragments and man-made particulates in orbit is approximately 4-5 per cent.

The largest concentration of space debris is observed at altitudes of 800, 1,000 and 1,500 km at inclinations ranging from 60 to 100 degrees.

At the existing rate of growth of debris in circumterrestrial space, in 20 to 30 years access to outer space will be considerably more difficult.

If space debris continues to increase at the current rate, the probability of collision with dangerous debris in low orbits will double or triple every decade.

The assessment of the current accumulation of space debris in low-Earth orbits and its predicted increase point to the need to take timely technical and legal measures to reduce the growth rate of such debris.

Technical measures include:

- Reducing the number of space vehicles launched while increasing their orbital lifetime and integrating their tasks;

- Refraining from destroying objects in orbit, in particular the deliberate destruction of a spacecraft;

- Excluding or reducing to a minimum the number of rocket stages and elements of space vehicles that separate in orbit;

- Non-use in outer space of propulsion systems using fuels that produce solid particulates during combustion;

- Use of materials and shields on space objects that are highly resistant to erosion due to the effects of circumterrestrial space;

- Controlled removal from working orbit of space vehicles that have ended their operational life, and their placement into the dense layers of the atmosphere or a graveyard orbit;

- Development of space launch programmes in which the last stage of the launch vehicle does not go into orbit (unbounded orbit launch) with the subsequent completion of the spacecraft's insertion into orbit using an apogee boost engine;

- Maximum use in future of space shuttle systems.

The preparation of legal norms and provisions should focus not so much on measures that restrict the use of space technology as on the improvement of such technology with a view to preventing the further accumulation of space debris.

The solution of this problem will require international cooperation.

Following are specific proposals for such cooperation:

1. Agreement on methods of cataloguing space objects, systematic exchange of reports on the movement of satellites, including information on objects still in orbit or which have left their orbits or have exploded;

2. Creation of a common database on objects presenting a high degree of risk (large satellites approaching the upper atmosphere, debris from explosions, objects that have gone out of control, and so on);

3. Exchange of samples that have been exposed to the effects of microfragments in outer space, as well as the results of their analysis. The conduct on board the Mir orbital station of a joint experiment involving the cataloguing of man-made particulates in outer space;

4. Modelling of the distribution of space debris in circumterrestrial space, the assessment and prediction of the risk of collision between objects of various descriptions. Comparison of the results of modelling;

5. Elaboration of standards to be met by the space industry with a view to reducing or preventing the further accumulation of space debris;

6. Development of a legal basis for regulating space activities with respect to the problem of space debris.

The study of various aspects of the problem of space debris was begun in the Russian Federation at the end of the 1970s. In recent years, research on debris in circumterrestrial space has become routine and comprehensive and includes the following basic areas:

1. Study of the origin of space debris and its accumulation in outer space, and elaboration of measures for its reduction;

2. Study of the physico-chemical interaction of space debris and space vehicles;

3. Data monitoring of the space debris environment through the observation of debris, study of the physical processes resulting in the formation of clusters of debris and the nature of their movement, and elaboration of measures to ensure the safety of space flight;

4. Solution of the scientific and technical problem of increasing the operational life of space vehicles up to 7-10 years;

5. Prevention of the disposal in outer space of structural elements of a new generation of spacecraft, and the return to Earth or combustion in the atmosphere of stages of launch vehicles;

6. Development of a system of basic data and a mathematical model of the evolution of space debris, the adequacy of which will be verified during space experiments, including the Obzor space experiment planned for 1992-1994;

7. Comprehensive research on the effects of space debris on space objects, modelling of the probability of the hypervelocity collision of man-made objects with space objects, and the search for ways and means of disposing of space debris.

A comparison of Russian, American and European data on the origin and accumulation of space debris in circumterrestrial space, carried out in the Russian Federation, showed that the three sources of data were in substantial agreement regarding the current level of space debris. At the same time, a certain divergence was noted in Russian and foreign assessments of the percentage of overall space debris caused by the explosion of space and launch vehicles produced by Russian space technology.

In January and February 1991, work on the monitoring of the last stage of the flight of Salyut 7/Cosmos-1686 and its re-entry was carried out. Such work received much international attention and involved, for the first time, the direct cooperation of Russian, American and European specialists in space monitoring.

A special scientific seminar organized by the European Space Agency was held at Darmstadt, Germany, from 8 to 14 April 1991. At the seminar, a Russian specialist reported on the results of the experimental testing of highly precise methods of predicting the movement of passive cosmic bodies (space debris). Russian specialists won high acclaim at the seminar for their accuracy in predicting the region and time of re-entry of debris from the complex.

SENEGAL

[Original: French]

To date, Senegal has not carried out any research in this area. However, this area of activity comes within the scope of the Institute of Applied Nuclear Technology of the Cheikh Anta Diop University of Dakar.